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XXXI.—*On some new or little-known Fossil Lycopods from the Carboniferous Formation.* By ROBERT KIDSTON, F.G.S.*

[Plate XI.]

THE following notes are offered as a small contribution to our knowledge of the Carboniferous flora of Britain. Several of the specimens now about to be described have been known to me for a considerable length of time, but various causes have contributed to delay their publication.

1. *Sigillaria McMurtriei*, Kidston, n. sp.
 2. *Sigillaria coriacea*, Kidston, n. sp.
 3. *Sigillaria Walchii*, Sauveur.
 4. *Lepidodendron Peachii*, Kidston, n. sp.
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1. *Sigillaria McMurtriei*, Kidston, n. sp.
(Pl. XI. figs. 3-5.)

Description.—Leaf-cushion rhomboidal, with the upper and lower angles truncated, giving it a hexagonal appear-

* Read before the Royal Physical Society, Edinburgh, March 18, 1885.
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ance, elevated; from the leaf-scar downwards runs a flattened area, which bears a slightly raised medial line; surface of the cushion ornamented with fine granulations placed in irregular lines and more prominent on the lower part of the cushion. Leaf-scar situated on the upward-directed elevated summit of the cushion, elongated, rhomboidal; lateral angles prominent and produced, the lower angle rounded, the upper rounded, with a slight sinus. Vascular cicatricules three, the two lateral oval and directed outwards, the central transversely linear and placed below the centre of the lateral cicatricules.

Remarks. This species of *Sigillaria* in some of its characters has a superficial resemblance to both *Lepidodendron* and *Lepidophloios*.

Figures 3 and 5 have very much the appearance as if the leaf-scar were surrounded by a "field," as in *Lepidodendron*; but the apparent "field" is merely a cortical extension, similar to the leaf-cushions in the Clathrarian *Sigillariae*, and only differing from the other members of this group of *Sigillaria* in its more highly developed condition.

On the lower part of the cushion occurs a flattened area, which runs from the lower rounded angle of the leaf-scar to the base of the cushion. In the centre of this band is a very gently raised line, from each side of which, at an almost imperceptible angle, slope the two sides of this flattened area. The surface of the cushion is ornamented with irregular granulations, which appear to be roughly arranged in lines springing from its base.

The extent to which the cushions are elevated is shown in the vertical sections, figs. 3 *a*, 4 *a*, and 5 *a*, which respectively represent sections of cushions and leaf-scars from specimens drawn at figs. 3, 4, and 5. From the examination of this part of the fossil it is evident that we are dealing with a cortical extension similar to the leaf-cushions of the Clathrarian *Sigillariae*, and not with the "field" of a *Lepidodendroid* leaf-scar.

The much-elevated cushions in *Sigillaria McMurtriei* have a considerable resemblance to those of *Lepidophloios*; but the character which at once proves this plant to be a true *Sigillaria*, and not a *Lepidophloios*, is the form of the vascular cicatricules. Of these the two lateral are linear-oval, the central transversely elongated and placed below the centre of the lateral cicatricules. In some cases the central cicatricule appears to be composed of two points placed closely together (fig. 3 *b*). A form and arrangement of the vascular bundle cicatricules such as that just described occurs only in the genus *Sigillaria*.

From the epidermal ornamentation of the cushions it is also clear that the leaf was not attached to any part of its surface, but to the vascular scar alone.

This last character is of itself sufficient to exclude the plant from *Lepidodendron* and restrict its relationship to *Lepidophloios* or *Sigillaria*; but, as already indicated, the vascular cicatricules are Sigillarian, and not those of *Lepidophloios*, and, in fact, there is here only a Clathrarian *Sigillaria* with highly developed leaf-cushions.

Of the three figures which I give of this plant figs. 3 and 5 must be regarded as representing the typical form.

On all the specimens the leaf-scar is of the same shape, but the slight sinus in its upper margin is sometimes very feebly developed.

In fig. 3 the ornamentation is more strongly marked on the portion of the leaf-cushion below the leaf-scar than on the part above it; in fig. 5 the ornamentation covers more equally the whole surface of the cushion.

In fig. 4, on the other hand, the ornamentation is very slightly represented; so little is it shown that it can scarcely be said to be present. Although on this specimen the leaf-scars are larger and their cushions more elevated than in figs. 3 and 5 (see fig. 4 a), it probably represents a younger state of the plant, which, when older, would have the cushions more drawn out, as in fig. 5.

As figs. 3, 4, and 5 are drawn of the natural size, it is scarcely necessary to give the measurements of the leaf-scars and their cushions; these also vary considerably with the age of the specimen. In all cases the leaf-scar is broader than high.

In the decorticated condition the surface of the stem is roughened by an irregular small mesh-like granulation, which is more or less arranged in vertical lines (fig. 5, part marked a).

The only species to which *Sigillaria McMurtriei* has any resemblance is *Sigillaria tumida*, Bunbury, sp. (*Lepidodendron? tumidum*, Quart. Journ. Geol. Soc. vol. iii. p. 432, pl. xxiv. fig. 1). From this species it differs in the form of its leaf-cushions. The surface-ornamentation in *Sigillaria tumida* also differs in being "rather irregular, wavy, longitudinal striæ."

Bunbury described his plant as *Lepidodendron? tumidum*, and Schimper places it in *Lepidophloios**; but I believe that this plant is also a *Sigillaria*.

In his description Bunbury does not mention the form of

* Schimper, Traité d. paléont. végét. vol. ii. p. 52.

the lateral cicatricules, nor does his drawing show it very clearly; but he says the central cicatricule consists of "two vascular points placed close together and often confluent."

In some of the leaf-scars of *Sigillaria McMurtriei* there is the same appearance in the central vascular cicatricule (see fig. 3 b). A similar structure occurs in the vascular impression of *Sigillaria Lorwayana*, Dawson*.

In *Sigillaria Moureti*, Zeiller †, a somewhat similar structure of the vascular cicatricule also occurs.

I have entered very fully into the description of *Sigillaria McMurtriei* to show that it is a true member of the genus *Sigillaria*; and from the great similarity of *Lepidodendron? tumidum*, Bunbury, to *Sigillaria McMurtriei* in all general points, I think there cannot remain any doubt as to its also being a Clathrarian *Sigillaria*. Bunbury himself expresses his difficulty in regard to the position of his plant, and says that it would be referred by some to *Lepidodendron* and by others to *Sigillaria*.

I first observed this species in the collection of Mr. J. McMurtrie, Radstock, after whom I have great pleasure in naming it. Mr. McMurtrie has not only carefully collected the fossil plants of the Radstock Coal-field, but has done much to elucidate the geology of his neighbourhood. I also take this opportunity of expressing my thanks to him for much valuable assistance received while examining the fossil flora of the Radstock Coal-field.

Horizon. Radstock series of the Upper Coal-measures.

Locality. Tyning Pit, Radstock, Somersetshire.

2. *Sigillaria coriacea*, Kidston, n. sp. (Pl. XI. fig. 2.)

Description. Ribs alternately widening and contracting; leaf-scars placed on the dilations, wider than high, with a slight sinus on their upper margin; lateral angles prominent, situated about the centre of the scar, with downward-running ridges; vascular cicatricules placed above the middle of the leaf-scar, the two lateral lunate, the central punctiform. Outer surface of the bark ornamented with a fine granulation.

Remarks. The only specimens of this fine *Sigillaria* with which I am acquainted are those in the British Museum,

* Dawson, 'Fossil Plants of Lower Carboniferous and Millstone-grit Formations of Canada,' p. 43 (woodcut), 1873.

† Zeiller, Bull. Soc. Géol. de France, 3^e sér. vol. viii. p. 210, pl. v. fig. 3.

which became known to me while preparing the 'Catalogue of the Palæozoic Plants' in that collection. All the specimens represent a similar age of the plant, and perhaps are different pieces of one individual.

The ribs measure across the dilated portions 22 millim. and at the constrictions 19 millim. The leaf-scars are 16 millim. broad and 12 millim. high, and 16 millim. apart.

The whole surface of the bark is ornamented with a fine granulation. On the central portion of the ribs it is more strongly marked and the granulation slightly larger than on the other portions of their surface; but its presence is distinctly seen over the whole area of the ribs.

The two lunate vascular impressions are 3 millim. long, and the central punctiform cicatrice is about 1 millim. in diameter. The sinus on the upper margin of the leaf-scar, though slight, is distinct.

The ornamentation of the bark is of a somewhat similar nature to that which occurs on *Sigillaria duacensis*, Boulay*, but much finer. From this species it differs entirely in the form of the leaf-scar and the position of the vascular cicatrices, which are central in *S. duacensis*, while those of *Sigillaria coriacea* are placed above the centre.

The specimens unfortunately do not bear any note of the locality from which they were collected; but from indirect evidence there is every reason to believe that they came from the Newcastle-on-Tyne Coal-field.

The figure (Pl. XI. fig. 2) is taken from a plaster cast of an impression of the plant in the British Museum. My thanks are due to Dr. H. Woodward, F.R.S., for permission to describe this species.

Horizon. Coal-measures.

Locality. (?) Newcastle-on-Tyne, Northumberland.

3. *Sigillaria Walchii*, Sauveur. (Pl. XI. fig. 1.)

Sigillaria Walchii, Sauveur, Végét. foss. d. terr. houil. de la Belgique, pl. lviii. fig. 3 †; Boulay, Terr. houil. du nord de France et ses végét. foss. p. 43.

Description. Ribs wide, smooth; leaf-scars separated by a short interval, subtriangular, as broad as high, the upper angle obtusely rounded, the lateral angles placed below the

* Boulay, 'Le terr. houil. du nord de la France et ses végétaux fossiles,' p. 43, pl. ii. fig. 3. Thèse de géologie présentée à la Faculté des Sciences de Caen: Lille, 1876.

† Académie royale des sciences, des lettres et des beaux-arts de Belgique, 1848.

centre, rounded, but distinct, the lower margin indented by a slight sinus; vascular cicatricules situated above the centre, the two lateral lunate, the central punctiform. On the ribs immediately above the leaf-scar is a slightly bent transverse furrow. The decorticated stem is finely striated longitudinally.

Remarks. In the specimen figured on Pl. XI. fig. 1, the ribs are 20 millim. broad; the leaf-scars, of pyriform outline, are 10 millim. in height and the same in breadth; they stand about 4 millim. apart. The slightly lunate transverse furrow which surmounts them is about 10 millim. long. The outer surface of the bark is quite smooth.

The elevation of the ribs is shown at fig. 1 *b*. They are flat, but, from the perfection with which the leaf-scars are preserved, I am inclined to think that the fossil has suffered little from pressure.

This example agrees in all respects with the figure given by Sauveur (without description) and that described by Boulay, except that neither of these authors notes the occurrence of the transverse furrow above the leaf-scar; but the specimens described by these writers do not appear to have been very well preserved.

Boulay mentions, in his description, that in his fossil the cicatricules were badly preserved; and from the slight haziness which pervades Sauveur's figure, one is also led to conclude that neither was it in a very good state of preservation.

The ribs on the Scotch specimen are broader in proportion to the size of the leaf-scars than in the foreign examples; but this character is evidently dependent on the age of the plant.

I have observed in specimens of *Sigillaria levigata*, Brongniart, that though the ribs with age increase much in width, the leaf-scars undergo little or no enlargement; hence the relative size of the leaf-scar to the width of the rib appears to be of very little specific value. The distance of the leaf-scars apart is also subject to much variation, even on the same specimen.

Sigillaria Walchii appears to be rare in Britain. The only example I have as yet seen was communicated to me for examination by Mr. J. Smith, Kilwinning, to whose courtesy I am indebted for the addition of this species to our Carboniferous fossil flora.

Horizon. Coal-measures; roof of turf-coal.

Locality. Kilwinning, Ayrshire.

4. *Lepidodendron Peachii*, Kidston, n. sp.
(Pl. XI. fig. 6.)

Description. Leaf-scars rhomboidal, the boundary lines of the upper part of the leaf-scar convex, those of the lower part concave, lateral angles prominent. Vascular impression slightly above the middle, rhomboidal, transversely elongated; from its lateral angles extends a raised line to the centre of the lateral angles of the leaf-scar, dividing the "field" into an upper and a lower portion. The upper part of the leaf-scar is slightly more elevated than the lower portion, which causes it to rise above the vascular impression in a hood-like manner. Vascular-bundle cicatricules three, punctiform.

Remarks. The figure shows on each side of the main stem the remains of a small branch; these are so much narrower than the stem which bears them that they give the fossil an appearance as if it possessed a lateral ramification, but these small branches are evidently the result of an unequally developed dichotomy. On a specimen of this plant from Newsham the same characteristic is exhibited.

On none of the few examples of *Lepidodendron Peachii* which I have seen, are the two little oval depressions shown, which in well-preserved *Lepidodendroid* leaf-scars are usually exhibited, one on each side of the median line immediately below the vascular impression; but their absence may be due to imperfect preservation.

Lepidodendron Peachii has a slight resemblance to *Lepidodendron Rhodeanum*, Sternberg; but in *Lepidodendron Peachii* the lateral angles are more prominent and the upper extremity of the scar much more rounded. The vascular impression is also more central and its angles more prominent.

The point, however, which at once separates this species from *Lepidodendron Rhodeanum* is the elevation of the upper portion of the leaf-scar. This is seen in profile at fig. 6 b. This peculiar inflation imparts to the leaf-scar a characteristic appearance, which at once distinguishes *Lepidodendron Peachii* from any other species of *Lepidodendron* with which I am acquainted.

Lepidodendron Peachii is also related to *Lepidodendron minutum*, Sauveur*, and *Lepidodendron Andrewsii*, Lesquereux†.

The figure given by Sauveur of his *Lepidodendron minutum* shows a fragment of a stem rather less than 2 inches long

* Sauveur, 'Végétaux fossiles d. terr. houil. de la Belgique,' pl. lxi. fig. 3 (1848).

† Lesquereux, 'Coal Flora of Pennsylv.' p. 389, pl. lxiv. fig. 6 (1880).

and about three quarters of an inch wide. The leaf-scars are about 4 millim. long and of about the same width; in outline some of them are hexagonal, especially towards the lower part of the figure. Notwithstanding, however, the general similarity of *Lepidodendron minutum* to *Lepidodendron Peachii*, without further evidence than that afforded by Sauveur's figure, which is unaccompanied by a description, it is quite impossible to identify the Scotch specimen as his plant.

Another example of *Lepidodendron Peachii* from Newsham, Northumberland, showing a younger branch on which the leaf-scars are smaller than on the Falkirk specimen, has also a like similarity with *Lepidodendron minutum*, but the objections mentioned in regard to the identification of the Falkirk fossil with Sauveur's species also apply to this.

The type of *Lepidodendron Andrewsii* is also fragmentary, and scarcely affords sufficient characters for a satisfactory comparison. Lesquereux says of his species, that "it is of the type of *Lepidodendron Volkmannianum*," to which group *Lepidodendron Peachii* can scarcely be said to belong.

The specimen which forms the type of this species was collected in 1870 by Mr. C. W. Peach, who some time ago submitted it to me for examination; but owing to the difficulty in identifying specimens of *Lepidodendron* with many of the described species without the opportunity of examining the types, it has been allowed to remain over till the present time. I have great pleasure in naming this plant after its discoverer, to whom I owe so deep a debt of gratitude for willing assistance given me in my study of the British Palæozoic fossil flora.

Horizon and Localities. Scotland: Coal-measures; Brickworks, Falkirk, Stirlingshire. England: Middle Coal-measures (low-main seam); Newsham, Newcastle-on-Tyne, Northumberland.

EXPLANATION OF PLATE XI.

- Fig. 1.* *Sigillaria Walchii*, Sauveur. From the roof of the turf-coal, Kilwinning (nat. size). 1 *a.* Leaf-scar, enlarged $1\frac{1}{2}$ diameters. 1 *b.* Section of specimen, showing elevation of ribs. Original in the possession of Mr. J. Smith, Kilwinning.
- Fig. 2.* *Sigillaria coriacea*, Kidston, n. sp. From (?) Newcastle-on-Tyne. Figure taken from plaster cast of specimen in the collection of the British Museum. (Nat. size.)
- Figs. 3-5.* *Sigillaria McMurtriei*, Kidston, n. sp. From Tynning Pit, Radstock, Somersetshire (nat. size). 3. Figure taken from plaster cast of impression in the author's collection, communicated by Mr. J. McMurtrie, Radstock. 3 *a.* Vertical section of one of the cushions (*a* indicates position of leaf-scar, *b* its supporting cushion). 3 *b.* Leaf-scar, enlarged $1\frac{1}{2}$ diameters, to show the

vascular cicatricules, the central of which is composed of two confluent dots. 4. Figure from plaster cast of an impression in the collection of Mr. McMurtrie. 4 a. Vertical section of one of the cushions. 5. Four cushions with their associated leaf-scars, from a specimen in the author's collection. Communicated by Mr. J. McMurtrie. The part marked *a* shows the decorticated condition. 5 a. Vertical section of one of the cushions.

Fig. 6. *Lepidodendron Peachii*, Kidston, n. sp. From the Brickworks, Falkirk, Stirlingshire (nat. size). Original in the collection of Mr. C. W. Peach. 6 a. Leaf-scar, enlarged 2 diameters. 6 b. Leaf-scar, shown in profile, enlarged 2 diameters.

XXXII.—*On the Relationship of the Sponges to the Choanoflagellata.* By FRANZ EILHARD SCHULZE*.

AFTER Dujardin, Carter, and Lieberkühn had demonstrated the agreement of certain cells of the sponge-body with *Amœba*, the Sponges were for a long time referred to the Protozoa. More recent investigations, however, have led to the conviction that they do not consist of colonies of homogeneous individual creatures, but of different tissues, that they reproduce sexually, and are built up out of at least two germinal layers, and consequently belong to the Metazoa.

As, however, some naturalists still continue zealously to maintain the Protozoal nature of the Sponges, it becomes necessary to test the arguments brought forward by them.

Within the last few years the opinion first put forward in the year 1866 by James Clark † has been defended with peculiar emphasis by Carter and Saville Kent—namely that the so-called *collared cells* of the sponges provided with a hyaline membranous annular frill are to be regarded, not as epithelial cells, but as *flagellate* Infusoria, and consequently the entire sponges as *colonies of Flagellata*. Somewhat as the whole of the individual animals in a colony of *Ophrydium* are placed side by side, imbedded superficially in a common gelatinous mass, so also in the Sponges the *spongozoa*, as Carter calls the collared cells, in accordance with the above-mentioned conception, are seated as independent creatures upon a common foundation after the fashion of a colony.

It is not to be denied that there exists a great similarity

* Translated from a separate impression of the paper in the 'Sitzungsberichte der Königlich-preussischen Akademie der Wissenschaften zu Berlin,' 1885, pp. 179-191.

† Proc. Bost. Soc. Nat. Hist. 1866, and Mem. Bost. Soc. Nat. Hist. 1868, vol. i.; see also Ann. & Mag. Nat. Hist. 1868, ser. 4, vol. i.